Background to 2016 Draft ACM Reference Manual
Section 2.2.3 (PV Credit)

(discussed at Staff Workshop 8/10/2015)

PV Compliance Credit

As this is a compliance calculation under 2016, it is necessary to devise a calculation that can be based on a 2016 calculation. Similar to the 2013 credit, it was decided to provide a PV credit equal to a specified fraction of the 2016 standard design. To calculate the credit, the prototypes were run using 2016 rules to establish the standard design, then a calculation with no high performance walls (HPW) or high performance attic (HPA). The difference between these two calculations in each climate zone is the maximum compliance credit, expressed as a percent of the 2016 standard design. On a statewide housing start weighted basis, the maximum PV credit is 19.8% of the 2016 standard design.

Assumptions

- Single Family Home, two prototypes (2100 ft2 & 2700 ft2)
- California average new construction starts for this analysis - 45% 2100 ft^2 one story, 55% 2700 ft^2 two story
- Concrete Tile Roof
- HPA = R-38 insulation at ceiling, R-13 insulation below roof deck
- HPW = R-19 insulation in cavity, R-5 continuous insulation
- No HPA = Attic per 2013 Standards Prescriptive requirements
- No HPW = Walls per 2013 Standards Prescriptive requirements

Proposal

The proposal was for the PV compliance credit to be equal to the 2016 prescriptive requirement with no HPW or HPA.

Note: HPW is not required in climate zones 6 and 7. HPA is not required in climate zones 1, 2, 3, 5, 6 and 7. Since zones 6 and 7 have neither HPW or HPA, there is no PV compliance credit in these zones.

A continuation of the 2013 credit requirement of at least 2 kWdc is also proposed. In some climate zones, larger houses may require more PV per Equation 2 (section 2.2.3 PV System Credit) of the 2016 Draft Residential ACM Reference Manual.

1. Maximum PV Compliance Credit, Single Family			
Climate Zone	**2016 Package** (kTDV/ft2)	**2016 No HPW, HPA** (kTDV/ft2)	**Savings** (%)
01	37.70	40.63	-7.8%
02	31.89	34.17	-7.1%
03	21.06	22.70	-7.8%
04	26.50	31.83	-20.1%
05	18.56	20.14	-8.5%
06	18.54	18.54	0.0%
07	12.10	12.10	0.0%
08	20.74	26.48	-27.7%
09	33.14	41.87	-26.3%
10	33.77	41.82	-23.9%
11	63.92	75.47	-18.1%
12	42.04	51.81	-23.2%
13	65.07	78.67	-20.9%
14	60.95	71.25	-16.9%
15	95.91	111.55	-16.3%
16	55.07	64.24	-16.7%
Weighted Statewide	**40.65**	**48.70**	**-19.8%**

Partial excerpt from 2016 Draft Residential Alternative Calculation Method Reference Manual (CEC400-2015-024-SD):

2.2.3 PV System Credit

The compliance credit available for photovoltaic (PV) systems is dependent on the climate zone and dwelling unit size. The credit may be used to tradeoff any efficiency measure, with limits as described below. The PV system must meet the eligibility requirements of Residential Appendix RA4.6.1 and must meet the minimum system size described below.

The PV compliance credit for both single and multi-family buildings is calculated by the compliance software and is equal to:

Equation 1: $PV_{credit} = TDV_{std} * PV_{maxpct} / 100.0$

Where:

PV_{credit} = PV compliance credit (kTDV/ft^2)
TDV_{std} = Standard Design Compliance Total (kTDV/ft^2)
PV_{maxpct} = Maximum PV Credit Percentage from

Table *Error! No text of specified style in document.***-1**

The minimum PV system size for compliance credit is calculated by the compliance software and is equal to:

$$\textit{Equation 2:} \quad PV_{minsize} = ROUND((PV_{threshold} + PV_{addedsize}) * N_{dwellingunits}, 0.1)$$

For average dwelling units less than or equal to $CFA_{threshold}$:

$$\textit{Equation 3:} \quad PV_{addedsize} = 0$$

For average dwelling units larger than $CFA_{threshold}$:

$$\textit{Equation 4:} \quad PV_{addedsize} = PV_{credit} * (CFA_{dwellingunit} - CFA_{threshold}) / PV_{genrate}$$

Where:

$PV_{minsize}$ = Minimum PV System Size (kWdc) for compliance credit
$PV_{threshold}$ = Threshold PV System Size per dwelling unit (kWdc) from Table 2
$N_{dwellingunits}$ = Number of dwelling units
$PV_{addedsize}$ = Added PV System Size (kWdc) required
$CFA_{dwellingunit}$ = Average Conditioned floor area per dwelling unit (ft^2)
$CFA_{threshold}$ = Average Threshold Conditioned floor per dwelling unit (ft^2) from Table 2
$PV_{generate}$ = PV Generation Rate (kTDV/kWdc) from Table 1

If the PV size entered by the user is less than PV minimum size then there is no compliance credit:

$$\textit{Equation 5:} \quad PV_{credit} = 0 \text{ when } PV_{usersize} < PV_{minsize}$$

Where:

$PV_{minsize}$ = Minimum PV System Size (kWdc) for compliance credit
$PV_{usersize}$ = PV size entered by user (kWdc)

Table** Error! No text of specified style in document.**-1: PV Credit Calculation Factors

Climate Zone	PV Generation Rate (kTDV/kWdc)	Maximum PV Credit for Single Family	Maximum PV Credit for Multi Family
01	26762	7.8%	5.0%
02	30021	7.1%	3.9%
03	31137	7.8%	3.3%
04	30935	20.1%	11.8%
05	33490	8.5%	2.4%
06	30081	0.0%	0.0%
07	30701	0.0%	0.0%
08	29254	27.7%	9.3%
09	29889	26.3%	10.7%
10	30200	23.9%	10.1%
11	29693	18.1%	9.0%
12	29328	23.2%	9.9%
13	29553	20.9%	9.4%
14	31651	16.9%	8.4%
15	29177	16.3%	7.4%
16	30930	16.7%	9.0%

Table** Error! No text of specified style in document.**-2: PV Threshold Factors

Dwelling Type	PV threshold (kWdc)	CFA threshold (ft^2)
Single Family	2.0	2000
Multi Family	1.0	1000

PROPOSED DESIGN

The software allows the user to input the rated power output of the solar system in kilowatts DC. If the rated system is greater than or equal to the minimum PV system size, the software calculates the solar credit and subtracts it from the proposed design. If the rated system is less than the minimum PV system size, the software sets the solar credit to zero and displays a message to the user that the minimum PV system size criteria was not met.

STANDARD DESIGN

The standard design has no PV system.

VERIFICATION AND REPORTING

A solar credit is reported as a *Special Feature* on the CF1R.